DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 03/24/2010 was filed after the same mailing date on 03/24/2010. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> *The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.*

3. Claims 10, 12, 13 are 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 10, 12, 13 and 14 depend on claims 2 or 8. Therefore claims 10, 12, 13 and 14 are rejected under 112 second paragraph as being indefinite because the claims have multiple alternatives dependent. Examiner suggested claim amendment in order to overcome 112 second paragraph as being indefinite.

4. Examiner suggested that numbers in bracket should be deleted claims 1 through 21, for example in claim 1 line (1) and line (8) should be deleted, then preamble can be replaced as follow as: Regarding claim 1, apparatus for optical inspection of an object comprising.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> *(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.*

6. Claims 1-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuyama (U.S. Publication number 2003/0206289 A1) in view of Matsuzawa (U.S. Publication number 7,761,257 B2).

Regarding claim 1, Matsuyama discloses apparatus for optical inspection (1) of an object, i.e., the imaging optical system (see paragraph [0008]), comprising:

an optical imaging system (5) for generating an actual image of the actual object (8), i.e., the imaging optical system within the image plane (see paragraph [0008]) a recording unit (7) (an image optical system) for recording the actual image of the actual object, i.e., imaging optical system within the image plane (see paragraph [0008]) and recording system (see paragraph [0017]).

Matsuyama does not disclose a calculation unit (12) for calculating an estimated image of an object of desired shape in respect of a known aberration coefficient of the optical imaging system (57, an image analysis unit (13) for detecting differences between the actual image and the image calculated by the calculation unit (12).

However, Matsuzawa discloses a calculation unit (12) (calculation unit) for calculating an estimated image of an object of desired shape in respect of a known aberration coefficient of the optical imaging system (57, an image analysis unit (13) for

detecting differences (evaluation value calculation unit) between the actual image and the image calculated by the calculation unit (12), i.e., evaluation value calculation unit(see item 18,fig.1) and image axis shape calculation unit (see item 15, fig.1).

Matsuzawa and Matsuyama are combinable because they are from the same field endeavor. At the time of the invention, it would have obvious to a person of ordinary skill in the art to make claim invention.

The suggestion/motivation for doing so would have been evaluating optical characteristics of an optical system based on an image forming position of a point image formed through the optical system. Therefore, it would have been obvious to combine Matsuyama with Matsuzawa to obtain the invention as specified in claim 1.

Regarding claim 2, Matsuyama discloses method for optical inspection of an object comprising the steps of:

generating an actual image of the actual object (8) by using an optical imaging system (5), wherein the aberration of the optical imaging system is known calculating a desired image of the desired object in respect of the determined aberration of the optical imaging system (5), detecting differences between the actual image and a desired image, i.e., to develop the wave front aberration or optical path difference of these light rays a power series (see paragraph [0039]).

Regarding claim 3, Matsuyama discloses method as claimed in claim 2, wherein the aberration of the optical system is determined, i.e., aberration polynomial (aberration function) that generally expresses the aberration polynomial function (see paragraph [0039]).

Regarding claim 4, Matsuzawa discloses method as claimed in claim 2, wherein the actual image is generated when the object (8) is approximately in a focal plane of the imaging system, i.e., confocal optical system (see item 59, fig.10).

Regarding claim 5, Matsuzawa discloses method as claimed in claim 2, wherein the actual image is generated when the object (8) is in a non-focal plane of the imaging system, i.e., confocal optical system (see item 59, fig.10).

Regarding claim 6, Matsuzawa discloses method as claimed in claim 2, wherein the step of generating the actual image comprises the sub-steps of: generating a first actual image when the object is in a first plane, i.e., calculation unit for calculating a plurality of image positions from the plurality of point light source images in the stack image recorded on the stage medium (see paragraph [0015]) and

generating a second actual image when the object is in a second plane, different from the first plane, the step of calculating the desired image comprises the sub-steps of, i.e., calculation unit for calculating a plurality of image positions from the plurality of point light source images in the stack image recorded on the stage medium (see paragraph [0015]):

calculating a first desired image for the object in the first plane, i.e., calculation unit for calculating a plurality of image positions from the plurality of point light source images in the stack image recorded on the stage medium (see paragraph [0015]) and

calculating a second desired image for the object in the second plane, i.e., calculation unit for calculating a plurality of image positions from the plurality of point

light source images in the stack image recorded on the stage medium (see paragraph [0015]) and the step of detecting differences between the actual image and the desired image, i.e., calculating a difference between the plurality of image positions by the first wavelength and the plurality of image positions (see claim 22 on the cited reference) comprising the sub-steps of:

detecting differences between the first actual image and the first desired image, and detecting differences between the second actual image and the second desired image, i.e., calculating a difference between the plurality of image positions by the first wavelength and the plurality of image positions (see claim 22 on the cited reference).

Regarding claim 7, Matsuzawa discloses method as claimed in claim 5, wherein the step of generating the actual image further comprises the sub-step of:

generating a further actual image when the object is in at least one further plane different from the first plane and the second plane, i.e., calculating a difference between the plurality of image positions by the first wavelength and the plurality of image positions (see claim 22 on the cited reference) the step of calculating the desired image further comprising the sub-step of:

calculating a further desired image when the object (8) is in at least a further plane, and the step of detecting differences between the actual image and the desired image, i.e., calculating a difference between the plurality of image positions by the first wavelength and the plurality of image positions (see claim 22 on the cited reference) further comprising the sub-step of:

detecting differences between the assigned further actual image and the further desired image, i.e., calculating a difference between the plurality of image positions by the first wavelength and the plurality of image positions (see claim 22 on the cited reference).

Regarding claim 8, Matsuzawa discloses method as claimed in claim 6, wherein the first plane is a focal plane of the imaging system, the second plane is above the focal p below the focal plane, i.e., confocal optical system (see item 59, fig.10).

Regarding claim 9, Matsuyama discloses method as claimed in claim 2, further comprising the step of: determining the aberration in predetermined time periods, i.e., an aberration acquisition unit for fitting an aberration model function to the plurality of image positions calculated by the image position calculated unit and obtaining an aberration measurement value (see paragraph [0015]).

Regarding claim10, Matsuyama discloses method as claimed in claim 2 or 9, further comprising the step of:

determining the aberration behind the startup of the optical imaging apparatus (1), i.e., an aberration acquisition unit for fitting an aberration model function to the plurality of image positions calculated by the image position calculated unit and obtaining an aberration measurement value (see paragraph [0015]).

Regarding claim 11, Matsuyama discloses method as claimed in claim 2, wherein the step of determining the aberration comprises the sub-steps of:

determining a first aberration before the optical image is generated, determining a second aberration after the optical image is generated, the desired image being

calculated by taking into account the first and second determined aberration, i.e., an aberration acquisition unit for fitting an aberration model function to the plurality of image positions calculated by the image position calculated unit and obtaining an aberration measurement value (see paragraph [0015]).

Regarding claim 12, Matsuyama discloses method as claimed in anyone of the claims 2 to 11, wherein the object is a lithography mask (9), i.e., an image of a pattern formed on a mask is projected and exposed onto a photosensitive substrate using an imaging optical system (see paragraph [0014]).

Regarding claim 13, Matsuyama discloses method as claimed in anyone of the claims 2 to 11, wherein the object is a pre-manufactured semiconductor device, i.e., semiconductor elements (see paragraph [0073]).

Regarding claim 14, Matsuyama discloses method as claimed in anyone of the claims 2 to 11, wherein the optical (5) imaging system (5) is an optical microscope, especially an optical immersions microscope or a EUV microscope, i.e., microscope optical system (see item 7b, fig.1).

Regarding claim 15, Matsuyama discloses method as claimed in anyone of the claims 2 to 11, wherein the optical imaging System is an electron microscope, i.e., microscope optical system (see item 7b, fig.1).

Regarding claim 16, Matsuyama discloses method as claimed in anyone of the claims 2 to 15, further comprising and the further plane is the step of identifying an area of error from the detected difference between the actual image and a desired image, i.e., the measurement value of the lateral chromatic aberration corresponding to the

object point position can be obtained as the difference between both (see paragraph [0095]).

Regarding claim 17, Matsuyama discloses method as claimed in claim 16, further comprising the step of inspecting the area of error by a further inspection method, i.e., determination of coefficients of respective terms in aberration polynomial on basis of Zernike coefficients obtained in approximation step(S13) (see item S14, fig.6).

Regarding claim 18, Matsuyama discloses method of manufacturing an object, comprising the steps of: manufacturing the object, inspecting the object by a method as claimed in anyone of the claims 2 to 17, adjusting the manufacturing of the object in respect of the desired object, manufacturing another object, i.e., transfer the image of pattern formed on reticle to respective shot areas on wafer using exposure apparatus (see item STEP 303, fig.7).

Regarding claim 19, Matsuyama discloses mask (9) comprising IC-Circuit structured areas (21) and an infinitesimally small structure (25), which is suitable for determination of the aberration of an optical imaging system (5) of claim 1, i.e., an image of a pattern formed on a mask is projected and exposed onto a photosensitive substrate using an imaging optical system (see paragraph [0014]).

Regarding claim 20, Matsuyama discloses mask as claimed in claim 19, wherein the mask comprises a recognition structure (23), i.e., an image of a pattern formed on a mask is projected and exposed onto a photosensitive substrate using an imaging optical system (see paragraph [0014]).

Regarding claim 21, Matsuyama discloses mask as claimed in claim 19, wherein the infinitesimal structure (25) is a small hole in accordance of the resolution of the optical imaging system (5), wherein the diameter of the hole is smaller than the resolution of the optical imaging system (5), i.e., an image of a pattern formed on a mask is projected and exposed onto a photosensitive substrate using an imaging optical system (see paragraph [0014]).

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aklilu Woldemariam whose telephone number is (571)270-3247. The examiner can normally be reached on Monday-Friday 8:00 a.m-5:00 p.m EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on 571-272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Aklilu Woldemariam/

Patent Examiner, Art Unit 2624

01/30/2012